

MAMMALS FROM CAMIGUIN ISLAND, PHILIPPINES

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Abstract.—Fifteen species of mammals are known to occur on Camiguin Island, a small oceanic island that lies near the north coast of Mindanao in the southern Philippines. Ten of the species are bats, one is a native Philippine rodent, and four are suspected of having been introduced (one insectivore, two rodents, and one carnivore). The depauperate nature of the non-volant land mammal fauna seems to be due to the lack of a Pleistocene land-bridge connection, although dispersal across a narrow salt-water gap by at least one rodent is implied.

The island of Camiguin is a small (265 km², 1713 m elev.), active volcanic cone that lies 8 km north of Mindanao in the Mindanao Sea (centered at 9°10'N, 124°43'E). In spite of Camaguin's proximity to Mindanao, the water between the two has a minimum depth of 385 m; thus it is unlikely that Camiguin was part of the Mindanao land mass during the Pleistocene. Because of these circumstances, Camiguin is potentially significant as an indicator of the importance of over-water dispersal by land mammals in the Philippines. However, the only previous records of mammals from the island are those of *Paradoxurus* by Gray (1843) and *Harpyionycteris whiteheadi* by Peterson and Fenton (1970). Additionally, the specimens reported here are important because the mammalian fauna of the southern Philippines is poorly known, especially on the small islands.

Three field teams from Mindanao State University collected mammals on Camiguin over a period of three years. The first, led by D. P. Empesso and R. B. Gonzales, collected from 17 to 31 May 1967; specimens are in the Royal Ontario Museum, Toronto (ROM). The second two teams, led by D. S. Rabor, worked on Camiguin from 11 to 28 June 1968, and 13 to 29 June 1969; specimens are in the Delaware Museum of Natural History (DMNH). Collecting was carried out by trapping, netting, and shooting. The purpose of this paper is to describe these collections, which include 215 specimens representing 15 species of mammals.

Methods

I took all cranial and forearm measurements with dial calipers graduated to 0.05 millimeter (mm); measurements listed are means (\pm one standard deviation for samples with $n > 3$). Limits of measurements are defined by DeBlase and Martin (1974). I measured forearms of all bats on dried skins. Distributional records are summarized for those species not covered by Heaney and Rabor (1982). Specimens examined from other islands in the Philippines are in the United States National Museum of Natural History (USNM).

Mammal specimens were obtained at ten localities; reference is made in species accounts only to the name of the Barrio or geographic feature. Mt. Timpong is more generally known as Mt. Mambajao; the names, spelling, and elevations given here are those used on the specimen labels. Specimens from the first seven localities are in the DMNH; those from the last three localities are in the ROM.

1. Catarman Mt., 2500–4500 ft, Catarman Municipality.
2. Gidag-on, 500–1500 ft, Catarman Municipality.
3. Kasang-sangan, 1000–2000 ft, Catarman Municipality.
4. Lasak-lasak, 4000–5200 ft, Mt. Timpong, Mahinog Municipality.
5. Matugnao, Mt. Timpong, Mahinog Municipality.
6. Puntod, 800 ft, Mahinog Municipality.
7. Mt. Timpong Peak, 5700 ft, Mahinog Municipality.
8. Mahidlaw, 2500–3500 ft, Mt. Mambajao, Catarman Municipality.
9. Sangsangan, 1400–3300 ft, Mt. Mambajao, Catarman Municipality.
10. Tag-ibo Cave, 400 ft, Catarman Municipality.

Accounts of Species

Order Insectivora

Suncus murinus occultidens. A single subadult specimen of the house shrew was taken on Mt. Timpong Peak. Although the cranium had not completed growth, measurements of the fully-erupted permanent dentition are typical of this widespread commensal species (Heaney *et al.* 1981; Taylor 1934). Measurements: I^1 to M^3 , 11.9; P^4 to M^3 , 6.4; M^2 to M^2 (labial), 8.4; palatal width at M^3 , 3.1.

Order Chiroptera

Cynopterus brachyotis luzoniensis. This geographically widespread species is apparently common at most elevations on the island. These bats averaged slightly smaller than a series from Dinagat and Siargao islands (Table 1; Heaney and Rabor 1982). Specimens examined: Lasak-lasak, 3; Kasang-sangan, 12; Mahidlaw, 2; Mt. Timpong Peak, 6; Puntod, 10; Sangsangan, 14.

Harpyionycteris whiteheadi whiteheadi. This species has been reported previously from Camiguin, as well as from Mindanao, Mindoro, and Negros (Peterson and Fenton 1970). Specimens examined: Kasang-sangan, 1; Lasak-lasak, 1; Mahidlaw, 1. The Mahidlaw specimen was reported by Peterson and Fenton (1970) as being from Langoangon, a misreading of the specimen label.

Macroglossus minimus lagochilus. This widespread nectarivorous species was apparently common on Camiguin. The specimens are slightly larger than those from Mindanao or Negros (Table 1; Heaney and Rabor 1982). Specimens examined: Kasang-sangan, 12; Matugnao, 5; Puntod, 2; Sangsangan, 8.

Ptenochirus jagori. Specimens of this species are intermediate in size between samples from Dinagat and Luzon (Table 1; Heaney and Rabor 1982). The previous record of this species from Camiguin reported by Heaney and Rabor refers to another island of the same name that lies off of northern Luzon (Andersen 1912). Specimens examined: Kasang-sangan, 6; Matugnao, 6; Sangsangan, 9.

Pteropus hypomelanus. Specimens of this series are similar in cranial morphology to those from Panay and Dinagat, but differ in color. The mantle of the Camiguin specimens is a sandy, golden-yellow color and extends in a continuous band onto the throat and chest; dark fur on the venter of the head is confined to the chin. The pale yellow fur extends slightly further laterally and posteriorly on

Table 1.—Mean measurements (\pm standard deviation) of adult bats from Camiguin Island, Philippines.

	Sex	n	Condylobasal length	Zygomatic breadth	Interorbital breadth	C ¹ to last M	Molariform toothrow	Forearm
<i>Cynopterus brachyotis</i>	♂	9	27.2 \pm 0.64	18.1 \pm 0.62	5.9 \pm 0.33	9.2 \pm 0.26	6.5 \pm 0.25	61.5
<i>Cynopterus brachyotis</i>	♀	16	26.5 \pm 0.56	17.9 \pm 0.47	5.7 \pm 0.28	8.9 \pm 0.29	6.2 \pm 0.21	61.5 \pm 1.7
<i>Harpyionycteris whiteheadi</i>	♂	1	41.5	25.1	6.7	16.4	12.5	87.5
<i>Harpyionycteris whiteheadi</i>	♀	1	40.5	24.3	6.9	15.7	11.8	—
<i>Macroglossus minimus</i>	♂	7	24.9 \pm 0.73	15.2 \pm 0.93	4.9 \pm 0.33	8.7 \pm 0.43	5.4 \pm 0.22	40.9 \pm 0.9
<i>Macroglossus minimus</i>	♀	4	24.9 \pm 0.50	13.6	4.7 \pm 0.22	8.6 \pm 0.53	5.6 \pm 0.62	41.5 \pm 2.3
<i>Ptenochirus jagori</i>	♂	7	34.5 \pm 0.56	24.0 \pm 0.58	7.1 \pm 0.35	12.2 \pm 0.30	8.6 \pm 0.35	78.6 \pm 2.3
<i>Ptenochirus jagori</i>	♀	5	34.6 \pm 0.53	23.8 \pm 0.70	7.3 \pm 0.27	12.3 \pm 0.24	8.8 \pm 0.26	79.6
<i>Pteropus hypomelanus</i>	♂	2	61.3	35.2	8.8	23.4	16.4	141
<i>Pteropus hypomelanus</i>	♀	2	61.0	34.8	9.1	23.6	16.1	138
<i>Pteropus tablasi</i>	♂	4	49.2 \pm 1.39	27.9 \pm 0.47	7.3 \pm 0.61	18.0 \pm 0.39	12.6 \pm 0.10	106 \pm 2.2
<i>Pteropus tablasi</i>	♀	3	48.6	27.5	6.9	17.5	12.2	105
<i>Emballonura alecto</i>	♀	2	13.8	8.7	2.8	5.5	4.0	44.2
<i>Rhinolophus arcuatus</i>	♂	6	19.8 \pm 0.43	10.1 \pm 0.24	1.8 \pm 0.19	7.8 \pm 0.17	5.6 \pm 0.06	43.1
<i>Rhinolophus subrufus</i>	♂	1	23.2	12.1	2.1	9.3	6.8	51.2

the venter, and has a sharper edge with the dark lateral fur, than on bats from Dinagat or Panay. The mantle and ventral fur on Camiguin specimens varies from pale yellow to sandy brown to golden on different specimens. Specimens examined: Gidag-on, 2; Matugnao, 2; Lasak-lasak, 1; Sangsangan, 3.

Pteropus tablasi. This small, golden-mantled flying fox was apparently common on Camiguin. Allocation of these bats to *P. tablasi* is tentative, pending revision of the species-group by D. J. Klingener (pers. comm.); there are no differences apparent between specimens from Camiguin and those taken at Lake Balinsasayao, Negros Island (Heaney et al. 1981). Specimens examined: Kasang-sangan, 19; Matugnao, 2; Puntod, 1; Sangsangan, 20.

Emballonura alecto alecto. Bats in this series average slightly larger than others from the Philippines (Heaney and Rabor 1982), but sample sizes are generally small, and no other differences are evident. Specimens examined: Sangsangan, 2; Tag-ibo Cave, 2.

Rhinolophus arcuatus exiguus. A series of six males is indistinguishable from a series from Montalban Caves, Rizal Province, Luzon (USNM). Previous records of this subspecies are from Guimaras, Mindanao (Taylor 1934), and Negros (Sanborn 1952); the nominate subspecies has been recorded on Luzon and Mindoro (Taylor 1934). I base the subspecies designation solely on locality. Specimens examined: Matugnao, 6.

Rhinolophus subrufus subrufus. The single specimen is indistinguishable from a series from Clark Air Base, Pampanga Province, Luzon (USNM). Other records of the subspecies are from Luzon, Mindanao (Hollister 1913), Mindoro (Lawrence 1939), and Tablas (Matschie 1898); *R. s. bunkerii* is known only from southern Mindanao (Lawrence 1939). Specimens examined: Matugnao, 1.

Pipistrellus sp. A single skin without skull appears similar to *P. javanicus*, but its specific identity must be regarded as uncertain. Specimen examined: Matugnao, 1.

Order Rodentia

Rattus everetti. Specimens from Camiguin appear very similar to a series from Mt. Katanglad, Mindanao (DMNH; Heaney and Rabor 1982). Only a single fully grown adult with damaged skull is present (Table 2). Specimens examined: Kasang-sangan, 4; Lasak-lasak, 1; Matugnao, 2.

Rattus exulans. Specimens of this commensal rat are similar to series from Dinagat and Mindanao (Table 2; Heaney and Rabor 1982); only a single adult is present. Specimens examined: Lasak-lasak, 1; Matugnao, 7.

Rattus rattus mindanensis. This common commensal rat was apparently abundant on Camiguin. Specimens from Camiguin average slightly smaller than a series from Mindanao, but are similar to several from Dinagat (Table 2; Heaney and Rabor 1982). Specimens examined: Catarman Mt., 2; Gidag-on, 6; Kasang-sangan, 3; Lasak-lasak, 6; Matugnao, 22.

An additional species of murid may be present on Camiguin, as indicated by a case involving mis-matched skulls. The skin of a juvenile *R. rattus* (DMNH

Table 2.—Mean measurements (\pm standard deviation) of adult rodents from Camiguin Island, Philippines.

	Sex	n	Condylobasal length	Zygomatic breadth	Mastoid breadth	Maxillary toothrow length	Diastema length	Total length	Tail length
<i>Rattus everetti</i>	♀	1	—	—	—	9.8	14.9	456	268
<i>Rattus exulans</i>	♂	1	31.8	—	13.9	5.6	8.8	277	144
<i>Rattus rattus</i>	♂	6	40.9 \pm 1.31	20.8 \pm 1.01	16.6 \pm 0.70	7.2 \pm 0.18	11.5 \pm 0.67	349 \pm 11.8	181 \pm 11.5
<i>Rattus rattus</i>	♀	6	40.8 \pm 0.77	21.0	16.5 \pm 0.49	6.9 \pm 0.32	11.2 \pm 0.41	364 \pm 13.3	191 \pm 11.8

4124) is mistakenly matched with the skull of a juvenile *Bullimus bagobus*. A specimen with the skin of a juvenile *R. everetti* (DMNH 4174) has a skull of a juvenile *R. rattus*. No *Bullimus bagobus* skin is present. It is possible that the mix-up occurred at the museum during the cleaning process or on Camiguin.

Order Carnivora

Paradoxurus hermaphroditus philippinensis. Gray (1843) listed specimens of *Paradoxurus* from Camiguin under the name *P. zeylanicus*. Thomas (1909) referred these specimens to *P. minax*, which Hollister (1913) regarded as very similar to *P. philippinensis*. Recent authors (e.g., Davis 1962) consider all Philippine members of this genus to be *P. hermaphroditus*.

Discussion

The known mammalian fauna of Camiguin is made up of three groups. The first group is composed of the bats, four of which are widely distributed in Southeast Asia (*Cynopterus brachyotis*, *Macroglossus minimus*, *Pteropus hypomelanus*, and *Emballonura alecto*), four of which are widespread in the Philippines (*Harpionycteris whiteheadi*, *Ptenochirus jagori*, *Rhinolophus arcuatus*, and *R. subrufus*), and one of which is confined to the southern Philippines (*Pteropus tablasi*). The second group is composed of commensal, introduced species (*Suncus murinus*, *Rattus exulans*, and *Rattus rattus*); *Paradoxurus hermaphroditus* is thought to have been introduced to some islands in Southeast Asia (Groves 1976), and may belong in this group. Finally, the endemic non-volant land mammal fauna is represented by *Rattus everetti*, and possibly by *Bullimus bagobus*.

Although the collecting may not have obtained specimens of all species present on the island, it was sufficient to support two major conclusions. First, it is apparent that Camiguin has a depauperate non-volant land mammal fauna relative to islands that were connected to Mindanao. For example, Dinagat, a shallow-water land bridge island, has 17 known non-volant land mammals compared to Camiguin's five (including commensals), although the two islands are similar in size (671 km² vs. 265 km², respectively). Camiguin is thus similar to islands in the Negros-Panay faunal region, which also support depauperate land mammal faunas and are thought to have lacked Pleistocene land bridge connections to Mindanao or other large islands (Heaney and Rabor 1982). Second, in spite of Camiguin's apparent lack of a land bridge connection to Mindanao during the Pleistocene, as suggested by a distance of 6.5 km in which the water depth is greater than 180 m, a large number of bats have crossed over to Camiguin, as has at least one rodent. Of these species, only one (*Pteropus hypomelanus*) shows evidence of morphological differentiation.

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Literature Cited

- Andersen, K. 1912. Catalogue of the Chiroptera in the collection of the British Museum. Vol. 1: Megachiroptera. 2nd ed. British Museum (Natural History) London. pp. ci + 1-854.
- Davis, D. D. 1962. Mammals of the lowland rain-forest of North Borneo. — Bulletin of the National Museum, Singapore 31:1-129.
- DeBlase, A. E., and R. E. Martin. 1974. A manual of mammalogy. — Wm. C. Brown Co., Dubuque, Iowa, 329 pp.
- Gray, J. E. 1843. List of the specimens of mammals in the collection of the British Museum. — British Museum (Natural History). 216 pp.
- Groves, C. P. 1976. The origin of the mammalian fauna of Sulawesi (Celebes). — Zeitschrift für Säugetierkunde 41:201-216.
- Heaney, L. R., P. D. Heideman, and K. M. Mudar. 1981. Ecological notes on mammals in the Lake Balinsasayao region, Negros Oriental, Philippines. — Silliman Journal (Dumaguete, Philippines) 28:122-131.
- Heaney, L. R., and D. S. Rabor. 1982. Mammals of Dinagat and Siargao islands, Philippines. — Occasional Papers of the Museum of Zoology, University of Michigan 699:1-30.
- Hollister, N. 1913. A review of the Philippine land mammals in the United States National Museum. — Proceedings of the United States National Museum 46:299-341.
- Lawrence, B. 1939. Collections from the Philippine Islands. Mammals. — Bulletin of the Museum of Comparative Zoology 87:28-73.
- Matschie, P. 1898. Säugethiere von dem Philippinen. — Sitzungberichten der Gesellschaft Naturforschender Freunde zu Berlin 5:38-43.
- Peterson, R. L., and M. B. Fenton. 1970. Variation in the bats of the genus *Harpyionycteris*, with the description of a new race. — Royal Ontario Museum, Life Sciences Occasional Papers 17: 1-15.
- Sanborn, C. C. 1952. Philippine zoological expedition, 1946-1947. Mammals. — Fieldiana, Zoology 33:89-158.
- Taylor, E. H. 1934. Philippine land mammals. — Monograph of the Bureau of Science (Manila) 30: 1-548.
- Thomas, O. 1909. New species of *Paradoxurus* of the *P. philippinensis* group and a new *Paguma*. — Annals and Magazine of Natural History (series 8) 3:374-377.

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